

In the case of a MIMO radio communication system, radio channel coefficient determination with the aid of channel estimation is very complex. With a number M_{TX} of transmit antennae and a number M_{RX} of receive antennae, a total of $M_{RX} \times M_{TX}$ radio channel coefficients to be estimated therefore results for $M_{RX} \times M_{TX}$ radio transmission channels. Specifically, for a MIMO radio communication system with four transmit and four receive antennae, a total of 16 radio transmission channels results described by 16 radio channel coefficients.

In the case of an FDD (Frequency Division Duplex) radio communication system in particular, precise estimation of the radio channel coefficients requires long training sequences, which in turn take up a considerable number of radio transmission resources.

Transmitter-side pre-filtering of symbols to be sent is known from "Performance Analysis of MIMO Maximum Likelihood Receivers with Channel Correlation, Colored Gaussian Noise, and Linear Prefiltering", Mario Kiessling et al., ICC 2003, IEEE International Conference on Communications, vol. 5, 11.05.2003 - 15.05.2003, pages 3026 to 3030, XP002270467, USA. The described pre-filtering allows improved receipt of the symbols to be achieved in respect of the bit error rate BER and in respect of the signal to noise ratio SNR, with pre-filtering taking place on the basis of statistical algorithms.

Transmit-side pre-filtering is known from "Statistical Prefiltering for MIMO Systems with Linear Receivers in the Presence of Transmit Correlation" Kiessling, 57th IEEE Semi-annual Vehicular Technology Conference, VTC 2003, Jeju, South Korea, vol. 1, 22.04.2003 - 25.04.2003, pages 267 - 271,

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XP002270468, for the dimensioning of which there is no need for a precise knowledge of channel state information CSI.

Pre-filtering is carried out based on statistical values.

Further pre-filtering based on statistical values is known from "Statistical Prefiltering for MMSE and ML Receivers with Correlated MIMO Channels", Kiessling, WCNC 2003, IEEE Wireless Communications and Networking Conference Record, New Orleans, LA, USA, 16-20.03.2003, vol. 2, pages 919 - 924, XP002270469.

The object of the invention is to implement an estimation of radio channel coefficients involving little outlay and with greater precision in a radio communication system, in particular in a MIMO radio communication system.

The object of the invention is achieved by the features of claim 1. Advantageous developments are set out in the subclaims.

The claimed pre-filter is arranged on the transmit side before an antenna arrangement such that training sequences are fed via the pre-filter to antenna systems in the antenna arrangement for emission. Channel estimation takes place based on the training sequences to determine radio transmission channel characteristics, which are described by spatial correlations. The pre-filter is dimensioned as a function of the spatial correlations such that a predefined error value of an algorithm used on the receive side for channel estimation is achieved.

REMARKS

In accordance with the foregoing, the specification and claims 14 and 20-22 have been cancelled. Claims 10, 15, 17 and 24 have been amended. Claims 10-13, 15-19, 23 and 24 are pending and under consideration.

A new abstract has been provided to incorporate the suggestions made by the Examiner.

A substitute specification and a marked-up copy of the original specification are being filed herewith. No new matter is added with these documents. The specification has been amended to insert paragraphs which were added in the international application. Specifically, between paragraph [0007] and the summary of the invention, four paragraphs were added during prosecution of the international application. The Examiner is referred to amended sheets 2 and 2a, copies of which are enclosed. These sheets were filed in response to a written opinion and attached to the International Preliminary Examination Report (IPER). An English-language translation of the annexes to the IPER was filed concurrently with entry into the US National Stage.

In item 7, on page 8 of the Office Action, the Examiner indicates that claims 14-17 and 20-22 contain allowable subject matter. The independent claims have been amended to include the limitations of dependent claim 14, which has been cancelled. At least in view of this amendment and the Examiner's indication of allowability, it is submitted that all claims contain allowable subject matter. Accordingly, the prior art rejections should be withdrawn.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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